ROUTE 1 CORRIDOR
MP 5.0 to MP 15.0
SAFETY IMPACT TEAM REVIEW

May 19-21, 2003

Submitted to:
Mr. Jack Lettiere, Commissioner
New Jersey Department of Transportation

Prepared by:
Safety Impact Team Participants

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EXECUTIVE SUMMARY

The Safety Impact Team conducted a review of the Route 1 Corridor from Franklin Corner Road/Bakers Basin Road (MP 5.0) in Lawrence Township, Mercer County to Ridge Road (MP 15.0) in South Brunswick Township, Middlesex County from May 19 - 21, 2003. The New Jersey Department of Transportation (NJDOT) Bureau of Safety Programs has previously identified this portion of Route 1 as a high crash rate corridor, in addition to having identified two of its signalized intersections, Nassau Park Boulevard and Washington Road, as high crash frequency and severity intersections as part of the Bureau's Intersection Improvement Program. The purpose of this review was to have a multidisciplinary team evaluate the Route 1 Corridor to identify safety problems and provide recommendations for improvement using the three E's (engineering, education, and enforcement) approach.

A review of the crash data indicated that there is a high frequency of same direction (rear end and sideswipe) crashes along the Route 1 study corridor. In addition, a review of bicycle and pedestrian crashes indicates that, while few, those crashes that do occur along Route One are most often fatal for the non-motorized road users involved. In 2002, there were at least two pedestrian and one bicycle crash within the study area, all three of them fatal.

Crash data was used to identify those locations that experience a high number of crashes and should be reviewed on a site-specific basis. The identified locations included the intersections of Route 1 with Bakers Basin Road, Nassau Park Boulevard, Washington Road, Ridge Road and Harrison Street, and also Route 1 southbound in the vicinity of Emmons Drive, the Mercer Mall and the Quakerbridge Mall Ramps.

Findings and recommendations were identified for the engineering, education and enforcement components of traffic safety. From an engineering perspective, the team identified findings and recommendations from both an overall and concentrated perspective, which focused on specific high crash locations along the corridor. The education and enforcement components of the review focused on methodologies to raise motorists' awareness of traffic safety and to increase law enforcement for the study corridor. The major findings and recommendations are captured below.

Engineering *(see page 9 for more specific information)*

Route 1 is a highly traveled land access highway that experiences significant peak hour congestion. In general, the design of the Route 1 Corridor is not consistent throughout. As a result, the expectations of the motorized (vehicles) and non-motorized (pedestrians and bicycles) public are frequently violated. There is a lack of pedestrian and bicycle facilities throughout the corridor. In addition, the high traffic volumes along this corridor results in low pavement friction and rutting in some areas along Route 1. Some of the recommended improvements to address these findings include:

- Provide simple, clean and straightforward design consistency along the Route 1 Corridor wherever possible.

- Review signs along the Route 1 study corridor utilizing the Statewide Sign Review Initiative (SSRI) Team.
- Provide improved pavement markings using innovative striping techniques.
- Provide improved pedestrian, bicycle and transit facilities along the corridor.
- Modify signal timings and upgrade signals to current standards to improve efficiency, operation, and safety of the corridor for all travel modes.
- Employ queue detection to activate existing Dynamic Message Signs to alert and direct motorists when congestion exists along the corridor.
- Implement resurfacing techniques to increase friction/skid numbers.
- Develop an Access Management Plan for the Route 1 Corridor in cooperation with local municipalities.

Education *(see page 25 for more specific information)*

Crash statistics overwhelmingly point to driver inattention as a major contributing factor to motor vehicle crash occurrences along the study corridor. In addition, local police departments cited aggressive driving as a major contributing factor. Several opportunities were identified to increase driver awareness of traffic safety issues and to encourage all stakeholders to become involved in traffic safety campaigns along the corridor. Some of these opportunities include the following:

- Develop public information campaigns that include critical safety messages.
- Use existing Dynamic Message Signs to alert motorists to unsafe conditions.
- Create a Safety Impact Team website.
- Display posters and distribute brochures that include critical safety messages at area train stations and retail centers.
- Implement the Network of Employers for Traffic Safety (NETS) program for local offices and businesses along the corridor.
- Involve retail businesses lining Route 1 in a roadway safety program.
- Encourage Malls and businesses along the corridor to place safety related signs and road stencils at their entrances and exits.
- Keep legislators, mayors, police chiefs, local traffic engineers, the media, and any other stakeholders current on the intent of the Safety Program and progress being made.

Enforcement *(see page 27 for more specific information)*

The NJDOT and law enforcement agencies should work together so that everyone is aware of new traffic safety initiatives. State and local police departments should be encouraged to institute a policy of zero tolerance on aggressive driving violation, as well as failure to wear seat belts. To ensure that these initiatives will be successful, grant monies should be provided so that state and local police departments can increase their presence along the corridor to target aggressive driving and seat belt violations. In addition, these initiatives will need the support of the court system to ensure that the penalties are administered. Other education and enforcement initiatives should include the use of the existing variable message boards and speed monitoring trailers.

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INTRODUCTION

Safety is one of New Jersey Governor McGreevey's highest priorities. Recently, the New Jersey Department of Transportation Commissioner Jack Lettiere launched the Governor's "Safety First" initiative, a plan that combines engineering, education, and enforcement to implement solutions to make New Jersey's roadways safer. The New Jersey Department of Transportation (DOT) has invited a multi-disciplinary team to be part of a permanent task force to further these safety initiatives along our roadways.

As part of the DOT's Safety Program, the Federal Highway Administration (FHWA) made a commitment to organize a USDOT Safety Impact Team (SIT) to conduct a multidisciplinary safety analysis and provide recommendations along one of New Jersey's "Safety Corridors." A Safety Corridor is defined as a roadway that has experienced a higher than average exposure to crashes as compared to similar roadways. The DOT has developed a list of those roadways and will be implementing a program for doubling the fines for traffic violations along these corridors. The SIT Program will be utilized on other Safety Corridors in the future.

Background

The Route 1 Corridor extends approximately 65 miles in New Jersey, beginning at the border of Pennsylvania and terminating close to the New York border. The road dates back to pre-Revolutionary War days. It is a major corridor linking Philadelphia to New York. Today the road is 2 to 4 lanes in each direction, with commercial, retail and some residential development. It is classified in some sections as urban freeway/expressway or urban principal arterial. 2001 crash data shows that this route exhibits the state's highest number of crashes and fatalities.

The portion of Route 1 under review is a ten-mile section of roadway from milepost 5.0, in the vicinity of Franklin Corner Road/Bakers Basin Road, to milepost 15.0, in the vicinity of Ridge Road *(see Study Corridor Map in Appendix A)*. The roadway has all the characteristics described above, with most of the section being an urban principal arterial. The number of specific crash types and their respective crash rates are above the statewide average, while the number of fatalities is below the average. Generally, there is a clear overrepresentation of same direction (rear end and sideswipe) crashes along the corridor.

What is a Safety Impact Team?

The Safety Impact Team is a multi-disciplinary team of highway safety stakeholders. Members include representatives from the NJDOT, FHWA, National Highway Traffic Safety Administration (NHTSA), the Federal Motor Carrier Safety Administration (FMCSA), New Jersey State Police (NJSP) and the New Jersey Division of Highway Traffic Safety (NJDHTS).

The purpose of the SIT is to develop comprehensive solutions to significantly reduce crashes and fatalities utilizing the three E's (engineering, education and enforcement) approach at high crash/fatality locations along the corridor. The team looked for immediate short-term solutions that would be considered "quick fixes," in addition to identifying intermediate and long-term solutions.

Approach

The methodology for conducting this review was as follows:

- Identify the high crash corridor to be analyzed (NJDOT selected a portion of a Safety Corridor previously identified as a high crash location);

- Compile data elements to be used for analysis of the corridor, including
  --crash rates and number of fatalities/injuries/property damage only
  --summary of crash records
  --traffic volumes and signal timings
  --vehicle classification and straight line diagrams
  --roadway geometry and typical sections
  --pavement condition (friction data/skid #s, age, type, etc.)
  --scheduled construction or maintenance work in the area

- Prepare crash diagrams to identify locations of over-represented crashes;

- Identify potential significant crash locations;

- Review existing conditions, data elements and crash diagrams with the Team members; identify additional information that may be needed; formulate the plan on how the field review will be conducted;

- Conduct the field review with Team members;

- Review findings and potential recommendations with the Team members; develop a draft outline;

- Prepare a final report detailing the findings, short, intermediate and long-term recommendations, implementation plan, and final conclusions.

Implementation

The DOT has an established process for implementing short, intermediate and long-term solutions to safety issues. The SIT has identified potential solutions for each intersection within the review area and an overall set of potential solutions for the entire corridor. The proposed solutions will be analyzed by the NJDOT to identify who will be responsible to implement that recommendation and the anticipated time frame for completion.

The DOT previously identified some immediate improvements from the preliminary findings and recommendations that are currently in the implementation process. These will be accomplished through the work order process initiated by the Bureaus of Safety Programs and Traffic Engineering and Investigations. The short term (immediate to 9 months), intermediate

term (9 months to 2 years), and long-term (more than 2 years) recommendations will be investigated for feasibility and addressed shortly thereafter.

Evaluation

The NJDOT should prepare a report to be submitted to the Safety Impact Team responding to each of the recommendations, the anticipated timeframe for actions and status thus far. To determine the effectiveness of the Safety Impact Team program, an evaluation process is also necessary. Such an evaluation should include, at a minimum, a comparison of the crash data prior to and after the implementation of the recommended improvements. It is also important to gain an understanding of the public's perception of the program through their feedback.

OPERATIONAL CHARACTERISTICS

The Route 1 study corridor extends from Bakers Basin Road (MP 5.0) in Lawrence Township, Mercer County to Ridge Road (MP 15.0) in South Brunswick Township, Middlesex County. In general, Route 1 is a six-lane, divided Urban Principal Arterial with a 55 MPH posted speed limit. However, there are some areas along the study corridor where there is only a four or five lane cross section. The Route 1 study corridor is a land use highway that consists of both signalized intersections and grade separated interchanges. The signal timings for each of the signalized intersections are included in *Appendix B*.

The Route 1 Corridor has four distinct travel patterns throughout the week. Monday to Friday, Route 1 is a major commuter route to and from the Greater Princeton Area's high-end office and commercial establishments. During the peak hours, a significant amount of this traffic comes from I-295/I-95. As such, there are instances when the interchange backs up onto the interstate, sometimes to the Sloan Avenue interchange along northbound I-295 and to Princeton Pike along southbound I-295/I-95. The traffic utilizing I-295/I-95 to reach Route 1 uses the shoulder as well as the outside travel lane as stacking lanes. The middle through lane is often used to bypass the queued vehicles and at the last minute erratically exit to Route 1. The inside or fast travel lane is traveling at speeds in excess of 70 MPH. Route 1 also provides access to the rail commuter stations at Princeton Junction, Washington Road, Sloan Avenue and Trenton. In addition, there are two New Jersey Transit bus routes along the Route 1 study corridor.

Other contributions to the Route 1 traffic congestion are the presence of four universities and regional shopping malls. The universities are either located along or have access to the corridor and include Rider College, College of New Jersey, Princeton University and Rutgers University. The regional shopping malls having direct access to Route 1 include the Quakerbridge Mall, Mercer Mall and Nassau Park Retail Center. There are two (2) Transportation Management Association's (TMA's) that serve the Route 1 study corridor, the Greater Mercer TMA and Keep Middlesex Moving. The TMA's are essentially outreach organizations that promote alternatives to driving for both work and recreational purposes.

The Route 1 Corridor continues to accommodate new development. There is currently new housing being developed and the traffic resulting from 500-700 new housing units will also utilize the Route 1 Corridor. In addition, there is an anticipated development of 6 million square feet of commercial space and two million square feet of office park along the study corridor.

There is significant peak hour congestion and delay experienced by motorists along the Route 1 Corridor. As a result, motorists seek alternative routes and use the local roads adjacent to Route 1 to reach their desired location. This leads to traffic congestion and delays on the local streets. Route 1 is heavily traveled by trucks as it parallels the New Jersey Turnpike and there are no tolls associated with the State Highway. The significant volume of truck traffic includes a large number of independent garbage trucks.

Various units within the NJDOT provided a significant amount of data and information to the team. This data and information includes traffic volumes, ongoing roadway projects that are

either in planning or construction, pavement management data and future projects, and signal plans and timings. A brief description of this data is provided below.

Traffic volume data was obtained for the Route 1 study corridor between MP 5.0 and MP 15.0. This data was obtained at different locations throughout the corridor from 1999-2002. From these counts, the 2002 Average Annual Daily Traffic (AADT) volumes and the 2002 daily vehicle miles traveled (DVMT for all vehicles and heavy trucks) were obtained, which are illustrated in Table 1 below.

Table 1
Route 1 Traffic Data

MP Start	Limit Start	MP End	Limit End	2002 AADT	2002 All Vehicle DVMT	2002 All Heavy Truck DVMT
5.00	Begin	5.46	Carnegie Road	40,569	18,662	1,754
5.46	Carnegie Road	6.90	I-295	74,570	107,381	10,094
6.90	I-295	11.29	CR 571	75,161	329,957	27,716
11.29	CR 571	12.37	CR 614	77,420	83,614	4,933
12.37	CR 614	14.57	CR 522	53,220	117,084	6,908
14.57	CR 522	15.00	End	48,583	20,891	1,233
				Total	677,588	52,638

There are no estimates of pedestrian or bicycle traffic, but worn paths exist along the highway. In addition, bicycle lockers at the local train stations are completely utilized on the weekdays, indicating the presence of bicycle traffic along the corridor.

There are currently several projects within the study corridor that are ongoing in the NJDOT's Department of Project Planning and Development. These projects include the following:

- Route 1/Quakerbridge Road Interim Operational Improvements Project that is currently under design, which includes building a collector distributor road on the northbound side of Route 1 at Quakerbridge Road. As part of this improvement, the light and jughandle Nassau Park Boulevard will also be removed. Also, a right lane will be extended on Route 1 northbound from the Motor Vehicle Inspection Station at MP 7.3 to the Quakerbridge Mall overpass at MP 7.5.
- Elimination of the Washington Road circle in Penns Neck, which is currently in the EIS stage under the lead of Capital Program Management.
- Route 1 Pedestrian overpass at the D&R Canal in Lawrence Township that is currently under construction
- Route 1/Franklin Corner Road intersection is currently pending initiation of concept development this year
- Route 1 Mercer County DMS & CD Study that is currently pending initiation some time this year

- Route 1 Widening Study revealed that Route 1 should be widened by one additional lane in each direction in South Brunswick from Independence Way to Finnegan's Lane. Preliminary concepts include traffic signal removal and prohibiting left-turns at Independence Way and Ridge Road. This project is currently in the Tier 2 Screening Report stage.

It should be noted that the proposed projects listed above were generally not considered as part of this review so as to not bias the team's recommendations. However, the NJDOT Value Engineering Bureau did consider several of these projects in developing the concept sketches illustrating the proposed recommendations.

There are currently no immediate plans for any pavement management projects within the study corridor. However, there are several areas that will be considered for the future. These projects include Route 1 northbound from MP 11.80 to MP 14.10, Route 1 southbound from MP 12.40 to MP 14.10, as well as Route 1 northbound and southbound from MP 3.80 to MP 5.30. Pavement Management data was provided for the entire study corridor for the team to review *(Appendix C)*.

CRASH CHARACTERISTICS

The NJDOT Bureau of Safety Programs (BSP) compiled 2001 crash data for the Safety Impact Team review. The crash detail sheets *(Appendix D)* were provided for the overall team to review. To better identify the crash problems along the Route 1 Corridor, BSP developed crash rates and summaries by types and conditions for particular sections of Route 1 and compared them to the 2000 statewide average crash rates and percentages for similar facilities *(Appendix E)*. These crash rates are summarized in Table 2 below. The crash summary sheets provide detailed information relating to the severity, type of crash, location, surface condition and time of day for each section and compares those characteristics with the statewide averages.

Table 2
Route 1 Crash Rates

Route 1 from…	2001 Crash Rate (crashes/mvm)	2000 Statewide Average Crash Rate (crashes/mvm)
MP 5.70 to MP 6.30	2.13	2.24
MP 6.30 to MP 7.00	1.52	2.24
MP 7.80 to MP 8.30	3.47	2.24
MP 8.30 to MP 8.80	6.25	2.24
MP 9.70 to MP 10.30	2.06	2.24
MP 10.40 to MP 10.90	3.01	2.24
MP 11.00 to MP 11.60	4.78	4.35
MP 11.60 to MP 12.30	1.75	2.24
MP 13.80 to MP 14.30	2.41	2.24
MP 14.30 to MP 14.90	4.26	2.24

The 2001 crash rates as summarized above, as well as the number and type of crashes per tenth mile were depicted on the NJDOT Straight Line Diagrams *(Appendix F)*. A review of the crash data indicates that there is a same direction (rear end, sideswipe) crash problem along the Route 1 study corridor.

The Safety Impact Team reviewed the crash data illustrated on the straight line diagrams to identify locations for site-specific review on the day of the field investigation. These site-specific locations and Year 2001 crash patterns/frequencies of concern are as follows:

- Route 1/Bakers Basin Road-Franklin Corner Road-19 NB, 13 SB same direction crashes
- Route 1/Nassau Park Boulevard-23 NB, 25 SB same direction crashes
- Route 1/Washington Road-14 NB, 20 SB, 9 EB, 6WB same direction crashes; 17 right angle collisions
- Route 1/Ridge Road-24 NB, 16 SB same direction crashes
- Route 1/Harrison Street-13 NB, 9 SB same direction crashes
- Route 1 southbound in the vicinity of the Emmons Drive-26 same direction crashes from South of Meadow Road to just north of Emmons Drive

- Route 1 southbound in the vicinity of the Mercer Mall-24 same direction crashes in the area of the SB frontage road, the two principal Mall driveways and the individual business accesses directly fronting Route 1
- Route 1 southbound in the vicinity of the Quaker Bridge Mall Ramps-10 same direction crashes potentially attributable to the substandard acceleration lane length of the SB on-ramp

FINDINGS & RECOMMENDATIONS

The Safety Impact Team reviewed the Route 1 Corridor from Bakers Basin Road (MP 5.0) in Lawrence Township, Mercer County to Ridge Road (MP 15.0) in South Brunswick Township, Middlesex County. The approach for the review included engineering, education and enforcement components. For the engineering component, the team reviewed the Route 1 Corridor from an overall general perspective and also a concentrated perspective, focusing on specific high crash locations along the corridor. The general review identified areas for improvement for the entire 10-mile study corridor. The site-specific review focused on those locations that experience a higher than average number of crashes (as identified in the *Crash Characteristics* section of this report). Areas for improvement were identified for each study location. The education and enforcement components of the review focused on methodologies to raise motorists' awareness of traffic safety and to increase law enforcement within the study corridor. A summary of the engineering, education and enforcement findings and recommendations are provided below.

The engineering findings and recommendations were categorized into three areas: short, intermediate, and long-term improvements. The short-term recommendations generally will be implemented through the NJDOT maintenance work order (Pipeline 4) process. The time frame for these changes generally ranges from immediate to nine months. The intermediate recommendations will be implemented through both the Pipeline 3 and 4 processes. The time frame for implementation of intermediate-term recommendations generally ranges from nine months to two years. The long-term recommendations will usually require major geometric improvements, study and analysis, and/or policy decisions. The time frame for implementation of the long-term recommendations is over two years.

ENGINEERING

In general, the design of the Route 1 Corridor is inconsistent. For example, shoulders exist in some areas whereas other areas have no shoulders. The number of through traffic lanes varies in the corridor. In addition, there is a mix of both traffic signals and grade-separated interchanges at intersecting roads along the Route 1 Corridor. As a result of these and other design inconsistencies, the expectations of the motorized (vehicles) and non-motorized (pedestrians and bicycles) public are frequently violated. These violations, coupled with the fact that Route 1 is a highly traveled corridor which experiences severe traffic congestion during the peak hours, results in an overrepresentation of same direction (rear end and sideswipe) crashes along the Route 1 study corridor. In addition, high traffic volumes along this corridor has resulted in low pavement friction and rutting in some areas along Route 1.

More specifically, there are unique problems associated with the signalized intersections along this corridor. It does not appear that the traffic signal timings (cycle lengths, offsets, green splits, etc.) are adequately serving vehicular or pedestrian traffic through the corridor. At some signalized intersections, signals heads and displays are sometimes not visible to motorists or pedestrians due to either the location of the signal heads or limited horizontal and vertical sight distance. In addition, left-turn and U-turn movements are accomplished via nearside jughandle

ramps. The design of these ramps is such that motorists exit the highway to the local streets at high speeds. There is a need to improve the ramp design to slow motorists down for the transition from Route 1 to local streets. This same problem exists at the grade-separated interchanges along the Route 1 Corridor.

The Route 1 Corridor contains various signs to instruct, warn and guide motorists in their daily travels. Based on the team's field investigation, there appears to be inadequate advance warning signs, as well as signing in general with respect to size, location, and retro-reflectivity. Throughout the corridor there is an abundance of signs that are not fulfilling a need. Many signs are worn out, hard to read, and may not command attention or respect, convey a clear, simple meaning, or do not provide adequate time for response. In addition to signs, pavement markings also instruct and guide motorists. Some areas along the Route 1 study corridor are in need of pavement marking enhancements relating to the width and retro-reflectivity of the striping.

There are various Intelligent Transportation System (ITS) technologies available along the Route 1 study corridor that are controlled by the NJDOT Traffic Operations Center (TOC) South. These ITS technologies include dynamic message signs (DMS), highway advisory radio (HAR) and video cameras (CCTV). The video cameras are used by TOC South to identify incidents. TOC South initiates incident management activities that include the use of DMS and HAR to alert motorists of the incident. These technologies are also available along I-295 northbound and southbound prior to the Route 1 interchange.

Within the study corridor, Route 1 is a land access highway that serves both the motorized and non-motorized public. However, there is a significant lack of pedestrian and bicycle facilities throughout the corridor. With respect to pedestrian and bicycle facilities, there are no sidewalks, striped crosswalks, median refuges or curb ramps to accommodate pedestrians. Pedestrian push buttons are provided at some of the signalized intersections; however, the locations are not always optimal for pedestrian access. In addition, there are no pedestrian signal heads along much of the study corridor. There are multiple access points along Route 1 serving the many land uses. These access points are not easily visible to motorists and also complicate movements for bicyclists in the shoulder area. The shoulders, which are where bicyclists ride, are not consistent throughout the corridor. Furthermore, there are no bicycle sensitive loop detectors along the Route 1 Corridor.

In December 1997 the RBA Group, Greenways Incorporated, and Bicycle Federation of America prepared a Route 1 Corridor Bicycle and Pedestrian Case Study for the New Jersey Department of Transportation. Key issues identified in this study include the benefits of bicycling and walking, constraints to these activities that currently exist and opportunities for improvement to accommodate bicycles and pedestrians along the corridor. In addition to the recommendations provided below, this document should also be consulted for use in addressing bicycle and pedestrian issues along the Route 1 Corridor.

The Route 1 study corridor serves at least two New Jersey Transit bus routes. Bus stop locations along Route 1 are not adequately signed nor are shelters or even pads provided for transit users to wait for the bus. In addition, there are four train stations in the surrounding area that are in high demand from both vehicular and bicycle traffic.

The Safety Impact Team participants identified general recommendations for areas of improvement along the Route 1 study corridor. These recommendations are provided below.

- Provide simple, clean and straightforward design consistency along the Route 1 Corridor wherever possible.
- Review the signing along the Route 1 study corridor utilizing the Statewide Sign Review Initiative (SSRI) Team.
  - ✓ Provide clear, concise and consistent signing through increased size, advanced warning, improved retro-reflectivity, and location.
  - ✓ Ensure that signs can accommodate the "older driver," which would at the same time improve safety for everyone.
  - ✓ Consider alternative backlit signing (i.e. electric stop sign).
- Provide improved pavement markings utilizing the following strategies:
  - ✓ Provide clearly delineated deceleration lanes at access points via closely spaced dashed edge lines.
  - ✓ Separate conflicting movements via a continuous right-turn lane with right-turn only pavement marking arrows in advance of major entrances.
  - ✓ Increase width of striping between through lanes and deceleration/right-turn/bicycle lanes.
- Provide pedestrian and bicycle facilities along corridor.
  - ✓ Sidewalks, striped crosswalks, pedestrian signal heads with push buttons, protected median refuges, and ADA considerations (i.e. curb ramps).
  - ✓ Consistent shoulders for bicyclists to ride, as well as bicycle sensitive loop detectors.
  - ✓ Investigate the provision of an alternate parallel route for bicyclists.
- Modify signal timings and upgrade signals to current standards to improve efficiency, operation and safety of the corridor for all road users. In addition,
  - ✓ Provide consistent location of and install larger and brighter (LED) signal heads for all side streets and additional signal heads for the Route 1 approaches where appropriate.
  - ✓ Add back plates to some traffic signals for improved conspicuity.
- Examine median barrier curb at intersections to facilitate more expeditious left-turning maneuvers and to ensure unobstructed pedestrian crossings. Attach object markers to end of median barrier sections, where missing, to identify the hazard.
- Employ queue detection to activate existing Dynamic Message Signs to alert and direct motorists when congestion exists along the corridor.
- Consider resurfacing techniques to increase friction/skid numbers and reduce rutting.
  - ✓ Resurface approaches to intersections on a more regular basis.
  - ✓ Use different type of pavement or surface treatment (i.e. Portland cement concrete, rubber strip thermoplastic, etc.) or milling and resurfacing techniques (i.e. polymer modified superpave or open graded mix) on Route 1 approaches to the intersection, as well as between intersections to reduce rutting and decrease skidding.
- Develop Access Management Plan for Route 1 Corridor in cooperation with local municipalities.

FRANKLIN CORNER ROAD/BAKERS BASIN ROAD (MP 5.98)

Franklin Corner Road (CR 546) intersects U.S. Route 1 from the west at milepost 5.98 and continues as Bakers Basin Road on the east side of Route 1. The current configuration of this intersection requires motorists traveling on Route 1 to exit via a nearside jughandle to conduct all turns (left, right and U-turn). Attention was drawn to this intersection due to the high frequency of same direction crashes along northbound Route 1 between MP 5.70 and MP 6.30. According to the crash records data there were 15 rear end crashes and four sideswipe crashes in this area. In addition, in 2002 there was a fatal pedestrian accident along Route 1 northbound just north of Bakers Basin Road.

During the site inspection by the team on May 20, 2003, several problem areas were identified at the Franklin Corner Road/Bakers Basin Road intersection. It should also be noted that Sergeant Thomas Macheda, Traffic Liaison from the Lawrence Township Police Department, joined us at the site to share his experiences. These findings are outlined below.

- The northbound right-turn lane appears to be too long at approximately 1,000 feet. The first advance intersection lane control sign is posted approximately 500 feet after the start of the designated right-turn only lane. The second advance intersection lane control sign is 335 feet north of the first sign and is partially blocked by the new Mercer County Community College (logo) directional sign that is located between the two lane control signs.
- The pavement friction is low on Route 1 approaching the intersection.
- There are several bus stops along Route 1 that are poorly marked *(see photos below)*.

- The regulatory signs need improved retro-reflectivity.
- The mast arm signs are old and the letter size too small.
- Lack of adequate pedestrian facilities (no crosswalks, sidewalks or curb ramps) and several pedestrians were observed crossing Route 1 *(see photos below)*.

However, there is a crosswalk shown on the approved traffic signal plan that was either not installed after the last resurfacing project or has faded away.

- The northbound jughandle geometry is not adequate for trucks. In addition, the jughandles lack provisions for pedestrian and bicycle crossings such as striped crosswalk, shoulder or bike lane *(see photos below)*.

- The left-turn from the northbound jughandle onto Bakers Basin Road is very difficult due to the volume of cars approaching from the east towards Route 1. The westbound traffic queues up quickly thus blocking left-turn movements from the jughandle.
- The motorists are using the shoulder along southbound Route 1 as a deceleration lane.

Recommendations

Short Term:

✓ Increase the size of the existing lane designation signs and add a "RIGHT-LANE FOR EXIT ONLY" sign along the northbound approach to the signal.

- ✓ Provide two additional arrows and "ONLY" markings in the northbound right-turn lane prior to the two existing "ONLY" markings.
- ✓ Investigate reducing the length of the northbound right-turn lane.[1]
- ✓ Replace existing 8" signal heads for split left-turn signals with 12" four-section signal heads.[1]
- ✓ Provide high-visibility crosswalks on three legs of the intersection and across all jughandle ramps.[1]
- ✓ Place object markers at the end of the concrete barrier (Adiem's).
- ✓ Prohibit trucks over 4 tons from using the jughandle to make left-turn and U-turn movements from Route 1 northbound. Guide the trucks via signage to use the cloverleaf interchange at Route 1 and I-295.[1]
- ✓ Replace signs with low retro-reflectivity and replace the mast arm signs with increased letter size.
- ✓ Sign bus stops along Route 1 and prohibit parking in front of them.

Intermediate Term:

- ✓ Investigate installing a dynamic warning sign "BE PREPARED TO STOP" in advance of the northbound approach to the signal on Route 1.
- ✓ Initiate a study to determine how the raised pavement markers will be affected if the striping width is increased from 8" to 12". Based on the results of this study, increase the width of the striping between the right-turn lane and the adjacent through lane on Route 1 northbound from the existing 8" to 10" or 12".
- ✓ Install sidewalks that extend from the intersection to logical termini, as well as handicap ramps where the crosswalk is located for pedestrians.[1]
- ✓ Install concrete waiting areas for pedestrians at the bus stops along Route 1.
- ✓ Delineate shoulder or bike lane for bicyclists within the project limits. Ensure that cyclists have somewhere to ride as right-turn lanes and jughandles occur.
- ✓ Extend southbound deceleration lane with skip lines with short spacing.[1]
- ✓ Investigate the installation of a traffic control device (i.e. traffic signal, "STOP HERE ON RED" sign or "DO NOT BLOCK INTERSECTION" sign) at the Bakers Basin Road intersection with the jughandle.
- ✓ Resurface Route 1 through the intersection.
- ✓ Investigate the possibility of constructing an additional left-turn lane on the westbound approach of Bakers Basin Road. Manual turning movement counts are needed to determine if this warranted.
- ✓ Investigate cutting back the concrete barrier to facilitate more expeditious turning maneuvers and to ensure unobstructed pedestrian crossings.
- ✓ Investigate the addition of protected pedestrian refuge islands in the center of Route 1.
- ✓ Consider the prohibition of U-turn/left-turn movements for all vehicles from Route 1 northbound and also the feasibility of revising Bakers Basin Road westbound to straight-in/right-in/right-out only. The NJDOT Value Engineering Unit has developed a concept sketch of this improvement and completed traffic analyses with SYNCHRO to demonstrate the benefits of this modification *(Appendix G)*.[1]

[1] The NJDOT Value Engineering Unit considered these recommendations in the development of concept plans.

Long Term:

- ✓ Relocate the northbound jughandle to behind Mrs. G's.

NASSAU PARK BOULEVARD (MP 8.50)

Nassau Park Boulevard intersects Route 1 at MP 8.50 and is controlled by a three-phase traffic signal. There is a northbound nearside jughandle, that is the eastbound approach to this intersection, to accommodate left-turn movements into the retail center, as well as U-turn movements to return to Route 1 southbound. There is also a southbound jughandle that previously accommodated U-turn and right-turn movements. However, at the time of the field visit they were adding geometric constraints to physically prohibit the left-turn movements from the jughandle to Nassau Park Boulevard. This intersection was selected because of the prevailing same direction crash history on both highway approaches as well as the pattern of right angle crashes involving southbound and westbound vehicles. In addition, in 2002 there was a fatal pedestrian crash at this location. Please note that there is currently a proposal to remove this traffic signal, which may impact the short-term recommendations at this location.

During the site inspection by the team on May 20, 2003, several problem areas were identified at the Nassau Park Boulevard intersection. It should also be noted that Patrol Officer Mary Louise Dranchak from the West Windsor Police Department joined us at this intersection to share her experiences. These findings are outlined below.

Findings:

- An angle crash problem exists with southbound motorists running the red light.
- Pedestrian push buttons are present with no striped crosswalks or sidewalks and there is a worn path along Route 1. There are two bus routes along Route 1 with poorly marked bus stops. *(See photos)*

- There is a sign on the traffic signal pole located on the southwest corner of the intersection that indicates, "PUSH BUTTON WAIT FOR GREEN LIGHT", but it is not clear which signal is to be viewed *(See photos)*.

- The traffic signal cycle length is 240 seconds during weekday AM peak hour (6:30-9:30 AM) and then converts to 90-second background cycle at 9:30 AM. A 120-second cycle is employed for the PM peak hour beginning at 3:30 PM. In addition, too much time is allotted to the side street movements midday, weekends and during the afternoon peak hour.
- There is an extremely long crossing distance for pedestrians at the intersection *(See photos)*.

- Crosswalks are not provided across jughandle entrances or exit ramps *(See photos)*.

Recommendations

Short Term:

✓ Add signal heads at the end of steel mast arms to complement median mount signal heads.

- ✓ Replace the existing side street signal heads with split left-turn arrow signals (four-section signal heads) and add back plates to signal heads where appropriate.
- ✓ Modify the traffic signal timing to improve traffic flow through the intersection.
- ✓ Provide pedestrian countdown signal heads.
- ✓ Stripe high-visibility crosswalks across all legs of the intersection and across jughandle ramps.
- ✓ Provide bus stop signs along Route 1.

Intermediate term:

- ✓ Investigate the removal of the northbound jughandle and revision of the NJ Transit bus routing schedule.[1]
- ✓ Install concrete waiting areas for pedestrians at the bus stops along Route 1.
- ✓ Install sidewalks that extend from the intersection to logical termini, including into the retail area.
- ✓ Investigate the addition of protected pedestrian refuge islands in the center of Route 1.
- ✓ Provide three through lanes along Route 1 and convert frontage road to one lane from Nassau Park Boulevard to the Mercer Mall. The NJDOT Value Engineering Unit has developed a red line plan of this concept *(Appendix H)*.[1]

Long-Term:

- ✓ Remove signal entirely.[1]

WASHINGTON ROAD (MP 11.27)

Washington Road (CR 571) intersects Route 1 at MP 11.27. The intersection is essentially a small traffic circle that is controlled by two traffic signals at the eastbound and westbound approaches to Route 1. There are three gas stations and a real estate agency located on the adjacent intersection corners that have access directly to the circle portion of the intersection. In addition, there is another traffic signal at Fisher Place that is approximately a tenth of a mile north of Washington Road. The Washington Road intersection was selected for site-specific review as it experiences the highest number of crashes along the Route 1 study corridor. More specifically, there is an overrepresentation of same direction and angle crashes at this location. There is currently a long-term study (Penns Neck EIS) underway that is considering major improvements to this intersection for the future. During the team's site inspection, several problem areas were identified at the Washington Road intersection. These findings are outlined below.

Findings:

- The traffic signal at Washington Road still operates on a fixed time basis as Traffic Signal Contract #10 has not been completed. Also, this and the adjacent traffic signal at

Fisher Place have simultaneous release to yellow points, but have differing returns to highway green.

- Crosswalks do not exist between the pedestrian push buttons, which are currently located on the northerly corners of the intersection. In addition, traffic signals are not visible to pedestrians at the location of the push buttons. *(See photos)*

- There are multiple access points located along the circle portion of the intersections.
- There are too many signs (regulatory and warning) providing information, which may be confusing to motorists.
- The Washington Road approaches to the intersection consist of two through lanes across Route 1 but are immediately constricted into one lane on the opposite side of the intersection.
- Trucks cannot turn left onto Route 1 from the designated lane on either Washington Road approach.
- Unconventional intersection design can be confusing to motorists who are not familiar with the area.

Recommendations

Short term:

- ✓ Interconnect traffic signals via modification of the signal timing for both the Washington Road and Fisher Place intersections.
- ✓ Stripe high visibility crosswalks across the north leg of the intersection.

Intermediate term:

- ✓ Remove center barrier section and modify intersection approach geometry and signalization. The NJDOT Value Engineering Unit has developed a red line plan of this concept. *(Appendix I)*[1]
- ✓ Stripe high visibility crosswalks on all legs of the intersection.
- ✓ Investigate the feasibility of restriping the Washington Road approaches for a single through lane and shoulders for bicyclists.
- ✓ Smooth the northerly curb return along the westbound approach to the intersection.
- ✓ Install pedestrian signal heads and push buttons where appropriate.
- ✓ Install bicycle sensitive loop detectors on the Washington Road approaches.

- ✓ Investigate cutting back the concrete barrier to allow for more direct pedestrian crossings at the intersection and providing pedestrian refuge islands in the center of Route 1.

Long Term:

- ✓ Implement Penns Neck EIS recommendations.[1]

RIDGE ROAD (MP 14.57)

Ridge Road (CR 522) intersects Route 1 at MP 14.57. At this intersection, left-turn, right-turn and U-turn movements from Route 1 are conducted via nearside jughandles. Attention was drawn to this intersection for review due to the high frequency of same direction crashes along the Route 1 northbound approach. More specifically, approximately 24 rear end crashes occurred at this location in 2001. During the site inspection by the team, several problem areas were identified at the Ridge Road intersection. These findings are outlined below.

Findings:

- Similar to the Franklin Corner Road/Bakers Basin Road intersection, there are insufficient gaps available along the westbound approach of Ridge Road for northbound left-turns movements from the jughandle to exit during the peak hours.
- The vertical sight distance along the northbound approach to the traffic signal may be inadequate.
- Similar too much of the rest of the Route 1 study corridor, there is a lack of pedestrian facilities at this location *(See photo)*.

- Severe peak hour congestion causes significant delays on the Ridge Road westbound approach.

Recommendations

Short Term:

- ✓ Install pedestrian push buttons and signal heads, as well as bicycle facilities at the intersection.
- ✓ Stripe high visibility crosswalks at the intersection.

- ✓ Increase Ridge Road traffic signal lenses to 12" and add back plates to traffic signals heads, where appropriate.
- ✓ Modify the traffic signal timing to improve Ridge Road level of service.

Intermediate term:

- ✓ Resurface northbound Route 1 approach to signal to improve friction on downslope.
- ✓ Install dynamic "RED SIGNAL AHEAD" sign along northbound approach to signal.
- ✓ Install bicycle sensitive loop detectors on the Ridge Road approaches to Route 1.

Long Term:

- ✓ Install far-side jughandle for northbound left- and U-turn movements.
- ✓ Extend three lanes on northbound Route 1 from the existing termination just north of Independence Way to beyond Ridge Road, keeping shoulders for bicyclists.

HARRISON STREET (MP 11.83)

Harrison Street (CR 629) intersects Route 1 from the west at MP 11.83. Opposite Harrison Street, the fourth leg of the intersection provides access to the Sarnoff property or General Electric. The Route 1/Harrison Street intersection is controlled by a three-phase, semi-actuated traffic signal. This intersection was selected for site-specific review due to the high frequency of same direction crashes in the vicinity of the intersection. During the site inspection by the team on May 20, 2003, several problem areas were identified at the Harrison Street intersection. These findings are outlined below.

Findings:

- There is a pedestrian push button located away from the intersection in a landscaped area on the southwest corner of the intersection *(See photo)*.

- Limited sight distance is available for right-turn on red movements from the eastbound Harrison Street approach.
- There is rutting along southbound Route 1 prior to the intersection.
- Trucks were observed approaching the traffic signal at a high rate of speed along northbound Route 1. This resulted in skidding and/or overheating their breaks in attempt to stop in time for the red light.

- Shoulders do not exist along Route 1 for bicyclists *(See photo)*.

Recommendations

Short Term:

- ✓ Restrict right turn on red movements along the eastbound approach with "NO TURN ON RED" signs.
- ✓ Install high visibility crosswalks on all legs of the intersection with ADA curb cuts and sidewalks leading to pedestrian push buttons.
- ✓ Provide a clear line of sight for eastbound motorists (i.e., trim back vegetation).[1]

Intermediate term:

- ✓ Install dynamic "RED SIGNAL AHEAD" sign on Route 1 approaches to the intersection.
- ✓ Resurface southbound approach to the signal to eliminate rutting and improve skid resistance.
- ✓ Install bicycle sensitive loop detectors on the Harrison Street approaches to Route 1.
- ✓ Eliminate the Sarnoff left-turn movements and respective jughandle to facilitate a revision to a two-phase traffic signal. The NJDOT Value Engineering Unit has developed a concept sketch of this improvement and completed traffic analyses with SYNCHRO to demonstrate the benefits of this modification. *(Appendix J)*[1]

Long Term:

- ✓ Investigate the potential to widen the Harrison Street eastbound approach to two lanes with either a L-LTR or L-TR lane designation.[1]
- ✓ Increase radius at northwest corner to better accommodate southbound right-turn movements.[1]

EMMONS DRIVE (MP 9.22)

Emmons Drive intersects southbound Route 1 at MP 9.22 and is stop-controlled. In the vicinity of Emmons Drive there are four travel lanes along southbound Route 1. In addition, there are

multiple access points that enter/exit via the outside travel lane. Attention was drawn to this location due to the high frequency of same direction crashes along Route 1 southbound. Upon further review, it was found that there has been a significant increase in rear end crashes (more than doubled from 2001 to 2002) in this area since the removal of the traffic signal at Market Fair Entrance and replacement of the shoulder with a fourth, auxiliary lane. In addition, during the site inspection by the team on May 20, 2003, a rut in the southbound pavement about 8" to 10" deep was observed.

To address these findings, the NJDOT should investigate converting the southbound outside travel lane to a shoulder or the possibility of re-striping the outside auxiliary lane with short spaced dashes to distinguish as "different" or as a right turn only lane and not a preferred through travel lane. The NJDOT Value Engineering Unit has developed a concept sketch illustrating this improvement *(Appendix K)*.[1] In addition, the NJDOT Maintenance Unit should resurface Route 1 southbound in the area of Emmons Drive to eliminate the rutting. Improvements to the signal timing at Nassau Park Boulevard should also reduce southbound back-ups to the intersection at critical times of the day and in turn reduce the attractiveness of the fourth lane currently being used as a queue bypass lane.

MERCER MALL

In the vicinity of the main entrance to the Mercer Mall, Route 1 southbound is divided by concrete barrier to split out express (to I-295/I-95) and local traffic. The frontage road that serves local traffic consists of two lanes, which drops to one lane in the vicinity of the Mercer Mall main entrance. Immediately after, the local traffic lane merges with the express roadway. This location was selected for review due to the high frequency of same direction crashes. During the site inspection by the team on May 20, 2003, several problem areas were identified in the vicinity of the Mercer Mall. These findings are outlined below.

Findings:

- The barrier separating the express and local lanes was damaged.
- There is no means for pedestrian crossing between Mercer, Nassau Park and Quakerbridge Malls.
- There is a lack of continuous shoulder for bicycle use.
- Through traffic destined for Route 1 south to Trenton or the I-95/295 Interchange was observed utilizing the frontage road to "beat" the mainline traffic that is barrier split just south of the Nassau Park Boulevard intersection.
- Frontage Road drops from two lanes to one lane without advance warning right at the point where the primary Mercer Mall driveway enters the Frontage Road.

Recommendations

Short-Term:

- ✓ Provide additional guidance signs and advance warning signs for Frontage Road (consider use of DMS signs in short term).

- ✓ Fix the damaged barrier between the local and express lanes.

Intermediate term:

- ✓ Remove existing barrier separation and replace with island but shifted to the right to maintain a one lane Frontage Road for mall traffic only. The NJDOT Value Engineering Unit has developed a concept plan illustrating this recommendation as part of the Nassau Park Boulevard recommendations. [1]
- ✓ Adjust camera just south of this location to capture pedestrian movements across the bridge. Conduct a Pedestrian Study to determine how to accommodate pedestrians safely in this area. Note that Mercer County provides a shuttle service along Route 1 Corridor.

Long Term:

- ✓ Implement recommendations of Pedestrian Study completed in the intermediate term as identified above.

QUAKERBRIDGE MALL RAMP

The Quakerbridge Mall ramps intersect southbound Route 1 at approximately MP 7.55. Directly south of the bridge abutments is an Amoco Gas Station with access directly to Route 1. There are three through lanes of traffic along Route 1 southbound in the vicinity of this location. This location was selected for site-specific review due to the high frequency of same direction crashes. The exact cause of these crashes is unknown and additional review of the crash records will need to be completed to see if these crashes are a result of the merge from the Quakerbridge Mall ramp. During the site inspection by the team, several problem areas were identified along Route 1 in the vicinity of the Quakerbridge Mall overpass. These findings are outlined below.

Findings:

- The acceleration lane from Quakerbridge Mall to Route 1 southbound is not of sufficient length (approximately 150 feet) due to geometric constraints associated with the adjacent Amoco site and loss of shoulder.
- Worn path up to overpass shows the desire for pedestrians to travel from the southbound side of Route 1 to the Mall located on the northbound side of Route 1 *(See photos)*.

Recommendations

Short Term:

- ✓ Investigate converting the existing yield condition along the ramp to a stop condition and change geometry with striping.[1]
- ✓ Install oversized merge sign so that southbound motorists are aware of the merge from the Quakerbridge Mall ramps.[1]

Intermediate Term:

- ✓ Shift through lanes to gain additional width for extension of the acceleration lane from the Quakerbridge Mall ramp to Route 1 southbound.
- ✓ Install dynamic signs indicating "Heavy Merge".
- ✓ Consider closing Quakerbridge Mall Ramp to southbound Route 1.
- ✓ Conduct a study to determine where pedestrians are traveling to and from in this area.[1]

Long Term:

- ✓ Extend Auxiliary Lane (providing 900 feet) from Quakerbridge Mall to the Red Lobster Property Line and consider building an access road behind all businesses. Requires a mini Access Management Plan or Multi-Party Developer Agreement and

the Revocation of the Amoco and Toy's R Us access points. However, it provides a continuous service road and alternative access to these properties and Red Lobster that would benefit all property owners as an improvement to their customers' ability to get in and out of their businesses with increased safety. This would serve all property owners as an improvement to their customer's. The NJDOT Value Engineering Unit has developed a concept plan illustrating this recommendation. *(Appendix L)*[1]

- ✓ Same general concept as above, but extend auxiliary lane from Quakerbridge Mall access to Route I-295.
- ✓ Install sidewalks along Route 1 to logical termini.
- ✓ Provide a means for pedestrians to cross Route 1 at this location.

EDUCATION

Crash statistics generated by the NJDOT, as reported by police agencies, overwhelmingly point to driver inattention as a major contributing factor to motor vehicle crash occurrences along the studied ten-mile segment of Route 1. Local township police officer testimonies also cite aggressive driving (which includes excessive speed, unsafe lane changing, improper turns and tailgating) as another viable reason for the crashes that occur. Drivers are being too easily distracted from safely operating their vehicles on this highly congested state highway.

Several opportunities exist to encourage drivers to stay more attentive and less influenced by distractions, and to encourage all stakeholders to become involved in traffic safety campaigns along the corridor. Recommended programs to target the various stakeholders are provided below.

Programs targeting the general motoring public

Public information campaigns should be created for motorists traveling along the Route 1 Corridor (and other similar roadways). Critical traffic safety messages should include how to determine the appropriate distance between cars stopped at lights or in traffic, how to effectively use land use as a visual cue when driving, and how to remain attentive and courteous while in traffic. This information should be distributed at DMV service centers, adjacent rail stations, and in businesses (corporate and retail) along the corridor, and should also be included in the DMV driver's manual.

Dynamic Message Signs (DMS) along the corridor, which at the time of the field visit displayed a "Buckle your seat belt – it's the law" message and currently reads "Report Aggressive Driving Cell #77", can also be used to alert drivers to unexpected, dangerous road conditions. We recommend that absent such conditions, continue to alternate the seat belt and aggressive driving messages and consider including additional messages such as, "Frequent sudden stops - stay alert" or the recently employed "Slow Down Keep Your Distance" wording.

Coupled with a general education campaign should be a visible enforcement presence. The presence of patrol cars would improve driver behavior without any other action being taken and sends a definite message to those who drive aggressively or inattentively.

A Safety Impact Team web site should be created or added to NJDOT's web site, where visitors can be made aware of SIT efforts. It should include the SIT team report for each corridor studied, additional data and crash statistics, links to partner agencies and organizations, and updates on accomplishments including crash reductions and other safety measures.

Programs targeting transit users

Three main train terminals - Trenton, Hamilton, and Princeton Junction - handle many thousands of vehicles whose occupants are headed towards New York City or Washington, DC. Posters in the terminals and trains, or pamphlets perhaps handed out with tickets could advertise the high incidence of same direction crashes and would get the traffic safety message out. The same type of program could be offered to New Jersey Transit for bus and train passengers who become pedestrians at the businesses and malls.

Programs targeting pedestrians and bicyclists

The Route 1 Corridor is ill equipped to accommodate pedestrians and bicyclists. Shoppers and workers arriving by foot or bus must frequently cross Route 1 without the benefit of sidewalks, signalized intersections or other facilities. We must raise the awareness of these users as to the unique, specific complexities associated with their actions as they cross Route 1 or move from site to site along Route 1. Working with retailers along the corridor, it is recommended that a campaign be created of posters and other visual aids for pedestrians and bicyclists, encouraging them to be alert, attentive and safe and providing them with specific guidance at each location as to potential safe, appropriate maneuvers. As pedestrian and bicycle facilities are upgraded along the corridor, non-motorists should be given guidance regarding the existence and proper use of these facilities.

Programs targeting corporations along the corridor

Many of the 677,000 vehicles using this roadway daily bring commuters to work in office buildings like Fleet Bank or retail businesses such as Wal-Mart or Home Depot. Companies like these are likely to welcome programs such as the Network of Employers for Traffic Safety (NETS) where safety specialists visit them to identify traffic problems, make presentations, distribute literature, and answer questions about traffic safety. Substantial monetary savings for all companies can be realized when motor vehicle crashes are lowered through decreased health care costs, vehicle and other insurance premiums, administrative and legal costs, reduced employee turnover and training costs for new hires, fewer fleet replacements, and other societal cost reductions. More information on NETS can be found at http://www.trafficsafety.org.

It is recommended that the NETS program be reinstituted in New Jersey and that an employer awareness program be created that provides employers in the area with information on both the human and economic cost of crashes, along with specific information to share with employees regarding driving the Route 1 Corridor.

Programs targeting retailers along the corridor

Quakerbridge, Mercer, Nassau Park, Market Fair Malls and the many other retail businesses lining Route 1 should be contacted about joining a roadway safety program. They more than likely belong to a retailers association or enterprise zone association, which would be very

interested in a program dealing with the safe and uneventful arrival and departures of their customers. Their participation in this program may also assure their assistance with the traffic engineering improvements being planned.

The malls and businesses could be encouraged to consider placing signs and road stencils at their entrances and exits informing drivers to be as safe as possible when re-entering traffic and to buckle their seat belts, and to create a campaign of posters and other visual aids alerting all highway users – motorists and non-motorists alike –to measures than can help ensure their safety on the roads.

Programs targeting other stakeholders

Lastly, it is important to keep legislators, mayors, police chiefs, local traffic engineers, the media, and any other stakeholders up to date on the intent of the program and progress being made. Their political assistance, ideas, and matching efforts whether engineering, enforcement or educational in nature can multiply the successes that are experienced. Periodic briefings with these individuals, agencies and organizations are critical to the successful implementation of many of the proposed engineering improvements.

ENFORCEMENT

The NJDOT and law enforcement agencies should work together so that everyone is on the same page with respect to new traffic safety initiatives. State and local police departments should be encouraged to institute a policy of zero tolerance on aggressive driving violation enforcement, as well as seat belt enforcement. To ensure that these initiatives will be successful, grant monies should be provided so that state and local police departments can increase their presence along the corridor to target aggressive driving and seat belt violations. In addition, these initiatives will need the support of the court system to ensure that these penalties are adhered to.

The NJDOT and partnering agencies should work together with state and local police departments to implement the strategies provided by NHTSA in *Aggressive Driving Enforcement: Strategies for Implementing Best Practices.* This document provides step-by-step assistance to law enforcement personnel in developing an aggressive driving enforcement program. Many of the strategies were developed based on the successful experience of various law enforcement agencies across the nation.

To increase seat belt usage along the study corridor and throughout the state of New Jersey law enforcement agencies should be encouraged to issue summons to all motor vehicle operators involved in a crash who were not wearing seat belts. Seat belt use is the best defense motorists have in the event of a crash. Therefore, seat belt enforcement should consist of both primary and secondary enforcement. As a primary offense, summons should be issued to motorists who are involved in a motor vehicle crash and are not wearing a seat belt. Summons should also be issued as a secondary offense when motorists are stopped for another violation (i.e., speeding, following too closely, etc.) and not wearing a seat belt.

Other education and enforcement initiatives should include the use of the existing variable message boards and speed monitoring trailers. Variable message boards can be used to remind motorists to wear their seatbelts and to encourage them to report aggressive drivers by dialing cell #77. Speed monitoring trailers can be used to alert motorists of their speed as compared to the posted speed.

CONCLUSIONS

The Safety Impact Team gathered for three days to conduct a review of a portion of the Route 1 Corridor. From this review, the team identified problem areas along the corridor and identified recommendations to improve safety throughout the corridor. These recommendations were in the areas of engineering, education and enforcement-the three E's approach. The anticipated success of the Safety Impact Team program is based on the assumption that the Department will follow through with the recommendations set forth in this report.

The Department should begin implementation of the education and enforcement recommendations immediately. The engineering recommendations were categorized into short-term, intermediate term and long-term, with an estimated time frame for implementation of immediate to 9 months, 9 months to 2 years and more than 2 years, respectively. In addition, there were several recommendations that require further investigation, which should also begin immediately.

The NJDOT should prepare a report to be submitted to the Safety Impact Team responding to each of the recommendations, the anticipated timeframe for actions and status thus far. To determine the effectiveness of the Safety Impact Team program, an evaluation process is also necessary. Such an evaluation should include at a minimum a comparison of the crash data prior to and after the implementation of the recommended improvements. It is also important to gain an understanding of the public's perception of the program through feedback. This could be accomplished through the Safety Impact Team website or surveys at the many businesses along the Route 1 Corridor.

By working together through engineering, education and enforcement, the safety of New Jersey's roadways can be improved significantly.

LESSONS LEARNED

The Safety Impact Team review of the Route 1 study corridor that occurred from May 19-21, 2003, was the first of it's kind in New Jersey. Based on the anticipated success of this review, it is expected that the NJDOT will continue reviews of high crash corridors in New Jersey utilizing multidisciplinary teams. At the completion of the review, several recommendations were offered to improve the process for future reviews. Incorporating these lessons into future reviews will result in a more comprehensive program.

The Safety Impact Team consisted of representatives from various agencies that included backgrounds in engineering, education and enforcement. However, there was far more representation in the area of engineering as compared to education and enforcement. As a result, the review was heavily geared towards the engineering side of the three E's approach. In future reviews, there should be a better balance of representatives from education and enforcement agencies. Depending on the characteristics of the corridor, additional representatives could include:

- New Jersey Transit
- Local authorities (i.e., police, municipal engineers and planners)
- Metropolitan Planning Organization (MPO)
- Transportation Management Associations (TMA)
- Board of Education (i.e., school transportation representatives)

While the multidisciplinary team that makes up the Safety Impact Team should be balanced between engineering representatives and representatives with education and enforcement expertise, it is important to maintain a manageable size team.

The NJDOT Bureau of Safety Programs provided 2001 crash data for the Safety Impact Team to review. Crash statistics were provided based on severity, crash type, location, surface condition and time of day. Recognizing that more than 80 percent of all crashes can be attributed to human error, in the future, additional crash statistics related to human factors and demographics should be provided (e.g. alcohol involvement, age, sex, time of day/day of week, and other causal factors). In addition, the number and severity of bicycle and pedestrian crashes should be separated from the overall crash statistics. The most recent crash data should be provided to represent any recent improvements or modifications to the corridor.

The Safety Impact Team review focused on the Route 1 Corridor only. It has been documented in this report that due to the severe congestion experienced along the Route 1 Corridor, motorists divert to adjacent local roads. Future reviews should consider this phenomenon and also investigate adjacent facilities to the extent appropriate.

The Safety Impact Team should take digital pictures at each site. These photos could than be used as visual displays at the meetings after the field review to assist in developing recommendations for improvement.

Similar to the provision of traffic counts, conflict counts should also be conducted at high crash locations along future "Safety Corridors." The purpose of a conflict count is to identify the number of "near" crashes. This type of analysis coupled with crash diagrams has proven to be very beneficial for field investigations and development of recommendations.

The Safety Impact Team has identified seventeen candidate sites for review. The Safety Impact Team Review is a very labor-intensive process. The Department should develop a mechanism to prioritize the list of candidate locations and determine how often this type of review should occur, within reason. The Department should then develop a timeline that lays out the study corridor, when each review will occur and when it will be completed.

APPENDIX A

Study Corridor Map

APPENDIX B

Signal Timings

APPENDIX C

Pavement Management Data

APPENDIX D

2001 Crash Detail Sheets

APPENDIX E

2001 Crash Summaries

APPENDIX F

Straight Line Diagrams with Crash Data (Number and Type)

APPENDIX G

Franklin Corner Road/Bakers Basin Road
Concept Plan

APPENDIX H

Nassau Park Boulevard
Concept Plan

APPENDIX I

Washington Road
Concept Plan

APPENDIX J

Harrison Street
Concept Plan

APPENDIX K

Emmons Drive
Concept Plan

APPENDIX L

Quakerbridge Mall Ramps
Concept Plan